Name:

Enrolment No:

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, June 2021

Course: PHYSICS I **Semester: I**
Course Code: PHYS1020
Programme:BTech : APE GAS, Chemical, ADE, Mechatronics, Mechanical, FSE, Civil **Max. Marks: 100**
Total pages: 2 **Time: 03 hrs.**

Instructions:

- All questions are compulsory (**Q12** has internal choice)
- Use blank paper as rough work to solve the questions in section-A and write only the correct options (type answers, no upload)

SECTION A

S. No.		Marks	CO
Q1.	A laser beam propagates through an optical fiber of 2.2 km long through TIR. At the entry side 450 mW power is fed. The output power is measured to be 150 mW. Loss coefficient is (a) 4.15 dB/km, (b) 2.17 dB/km, (c) 3.28 dB/km, (d) 1.55 dB/km	**5**	**CO1**
Q2.	The area of a hysteresis loop drawn between B and H is 200m^2. Each unit space along the vertical axis represent 0.005 Wb/m^2 and each unit space along the horizontal axis represents 10A/m. Determine the hysteresis loss per cycle per m^3 (a) 100 Joule (b) 5 Joule (c) 10 Joule (d) 20 Joule	**5**	**CO2**
Q3.	A dielectric material has very electrical resistance of $\rho = 5\times10^5$ ohm-m. If dielectric permittivity $\varepsilon = 3.7\varepsilon_0$ then how much time the dielectric takes to reduce its charge to 1/e time the initial value? (a) 16.4 μs, (b) 6.55 μs, (c) 16.4 ns, (d) 6.55 ns	**5**	**CO2**
Q4.	Find the expectation value of position of a particle having wavefunction $\Psi = ax$, between, $x = 0$ *and* 1, $\Psi = 0$ elsewhere. (a) a^2 (b) $\frac{a^2}{2}$ (c) $\frac{a^2}{4}$ (d) $\frac{a^2}{8}$	**5**	**CO3**
Q5.	If (3 2 6) are the Miller indices of a plane, the intercepts made by the plane on the three crystallographic axes are (a) (2a, 3b, c) (b) (a, b, c) (c) (a, 2b, 3c) (d) (3a, 3b, 2c)	**5**	**CO4**
Q6.	If the applied potential in a X-ray tube is 50 kV, then maximum wavelength of the produced X-rays is (a) 0.2 nm (b) 2 nm (c) 0.2 Å (d) 2 Å	**5**	**CO4**

SECTION B			
Q7.	Calculate atomic packing fraction (APF) of BCC crystal.	**10**	**CO4**
Q8.	Show that A/B ratio of Einstein co-efficients can be expressed as $\frac{A}{B} = \frac{8\pi h \nu^3}{c^3}$ the symbols have their usual significance	**10**	**CO1**
Q9.	Prove that an electromagnetic wave propagating in free space follows $\vec{k}, \quad \vec{E} \quad and \quad \vec{B}$ as mutually perpendicular to each other (you may consider, $\vec{E}$ along X, $\vec{B}$ along Y and propagation along Z directions).	**10**	**CO2**
Q10.	Discuss working of a Solar Cell with diagram. Calculate fill factor from the following data points, MPP = 200 mW, open circuit voltage V_{oc} = 2.5 volt, short circuit current I_{sc} = 150 mA.	**5+5**	**CO3**
Q11.	Write down the characteristics of a laser beam. Discuss 3-level and 4-level laser working with level diagram.	**2+4+4**	**CO1**
SECTION-C			
Q12.	(a) Discuss photoelectric effect with diagram and various characteristic graphs. (b) Write down the main characteristics of Schrodinger wavefunction. Sketch normalized wavefunction and probability function between 0 to L of a particle in a box problem. **OR** (a) Deduce the expression for Compton shift, in the form $\Delta\lambda = \lambda' - \lambda = \frac{h}{m_0 c}(1 - cos\theta)$ where θ is the angle made by scattered photon with incident direction (b) State Heisenberg uncertainty principle. Show that electron can not be a part of nucleus.	**10** **2+4+4** **10** **2+8**	**CO3** **CO3** **CO3** **CO3**
Physical constants: $h = 6.63 \times 10^{-34}\, J-s,\ c = 3 \times 10^8\, m/s,\ k_B = 1.38 \times 10^{-23}\, J/K, \mu_0 = 4\pi \times 10^{-7} H/m$ $\varepsilon_0 = 8.854 \times 10^{-12} F/m$, mass of proton= 1.6726 x 10^{-27} Kg			